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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/573,902	11/13/2006	James M. Tour	11321-P079WOUS	2103
61060	7590	06/05/2009	EXAMINER	
WINSTEAD PC			SAHA, BIJAY S	
P.O. BOX 50784			ART UNIT	PAPER NUMBER
DALLAS, TX 75201			1793	
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/573,902

**Applicant(s)**

TOUR ET AL.

**Examiner**

BIJAY S. SAHA

**Art Unit**

1793

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-9, 11 and 15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11 and 15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SG/US)  
Paper No(s)/Mail Date \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_.

### **DETAILED ACTION**

The amendment filed on March 9, 2009 under 37 CFR 1.312 has been entered.

#### ***Status of Application***

The amended and original **claims 1-9, 11 and 15** are pending and presented for the examination. The original **claims 10 and 12, 13 and 14** have been cancelled.

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 1-6, 8, 9 and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Tour et al WO/2002/060812 08/08/2002 (hereinafter WO '812).

Regarding **claim 1**, WO '812 discloses dispersing a quantity of derivatized carbon nanotubes in a solvent (claim 2), thermally defunctionalize the functionalized carbon nanotubes to form a defunctionalized product (claims 28, 29, 30 and 31).

Examiner considers that the independent claim 2 of the said reference WO '812 is drawn to the "derivatized carbon nano tubes in a solvent". The independent claim 2 reads on the dependent claims 28, 29, 30 and 31 drawn to removing "functional moieties" by "heating to a temperature at least about 250°C and 600°C". The solvent is considered to be first solvent.

Examiner further considers that the functionalized nano tube after heating is transformed into a defunctionalized nano tube per the claims 2 and 28-31 of WO '812.

Defunctionalized nano tube is suspendable as shown in the claim 3 of the said reference WO '812 and Example numbers 1-11 on page 5.

Regarding **claim 2**, WO '812 discloses single wall carbon nano tubes and assembly of carbon nano tubes (Page 2).

Regarding **claim 3**, thermal defunctionalization process is dependent upon the defunctionalization species and associate solvent. Defunctionalization may be possible at room temperature. It is expected that solvent is thermally stable. WO '812 discloses solvents acetonitrile solution (Example 1 page 5).

Regarding **claim 4**, WO '812 discloses "water and other hydrogen bonding solvents" (page 10).

Regarding **claim 5**, WO '812 discloses the synthesis of compound 10 (Page 7) where the suspension is completely enclosed in a vessel and "considerable pressure in the vessel" (page 11).

Regarding **claim 6**, WO '812 discloses dispersing the derivatized carbon nanotubes in a polymer (Claim 97).

Regarding **claim 8**, WO '812 discloses removing functional moieties from the derivatized carbon nano tubes (Claim 28).

Examiner considers removing functional moieties as completely defunctionalized or partially defunctionalized carbon nano tubes.

Regarding **claim 9**, WO '812 discloses carbon nanotubes defunctionalization wherein the nanotubes are in the polymer in an attached and un-attached state in the temperature range of 250°C to 600°C (Claims 27 to 31 and 98 to 103). Since defunctionalization is not selective and defunctionalization follows functionalization, it is expected that the nanotube after defunctionalization is homogeneous (MPEP 2144 [R-6]-IV C).

Regarding **claim 15**, WO '812 discloses solvent dichlorobenzene (Page 8).

At the time of invention it would have been obvious to a person of ordinary skill to defunctionalize carbon nano tubes using the art of WO '812.

**Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over WO '812 in view of Panhuis et al (Characterization of an Interaction, Journal of Nanoscience and Technology, 2003, Vol 3 No. 3 pages 209 to 213) (hereinafter Panhuis '209).**

Regarding **Claim 7**, teachings of WO '812 have been described in detail above.

WO '812 does not explicitly teach the application of a surfactant in the dispersion of carbon nano tubes suspended in a solvent.

Panhuis '209 teaches the application of a surfactant triton X-100 (Abstract and Page 212).

At the time of invention it would have been obvious to a person of ordinary skill to use a surfactant in the dispersion of carbon nano tubes in a solvent. The suggestion or motivation for doing so would have been to change the surface state of a nano tube from being completely hydrophilic to completely hydrophobic by carefully selecting the type of surfactant. Correct surface state of a nano tube being fully or partial hydrophilic to fully or partial hydrophobic determines its suspension in the solvent wherein the nanotubes is to be functionalized or defunctionalized.

**Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over WO '812 in view of Iijima et al (Nature, Vol 363, 1993, 603-605) (hereafter Nature '603).**

Regarding **Claim 11**, teachings of WO '812 have been described in detail above.

WO '812 does not explicitly teach the structure of a nano tube in a two dimensional notation.

Nature '603 teaches the orientation of the nano tube represented by an index (m, n) (Figure 3a page 604).

At the time of invention it would have been obvious to a person of ordinary skill to carry out the defunctionalization of nano tubes wherein the nanotubes are characterized

by (n, m) notation as suggested by Nature '603. The electronic properties and functionality depends upon (n, m) combination. A prior knowledge of vectors (n, m) is expected to selectively defunctionalize the nano tubes based upon the electronic state as pointed out by **Nature '603**.

### ***Response to Arguments***

Applicant's arguments filed January 22, 2009 have been fully considered but they are not persuasive.

**Claim rejection under 35 U.S.C. 102(b)** has been withdrawn. **Claims 1-6, 8, 9** and **15** are being rejected as being unpatentable over Tour et al WO/2002/060812 08/08/2002 (hereinafter WO '812). **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over WO '812 in view of Panhuis et al (Characterization of an Interaction, Journal of Nanoscience and Technology, 2003, Vol 3 No. 3 pages 209 to 213) (hereinafter Panhuis '209). **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over WO '812 in view of Iijima et al (Nature, Vol 363, 1993, 603-605) (hereafter Nature '603).

#### **Claim rejection under 35 U.S.C. 103(a)**

Regarding claim rejection 7, applicant agrees that Panhuis '209 teaches "application of the surfactant Triton X-100 to a solution of carbon nanotubes". As



Panhuis '209 points out (Scheme 1), the key role of a surfactant is to alter the surface state of carbon nano tube. A nano scale material such as a carbon nano tube, as Panhuis '209 points out, clustering or declustering in a solvent is a function of surface being totally hydrophilic from hydrophobic.

Regarding **claim 8**, WO '812 discloses removing functional moieties from the derivatized carbon nano tubes (Claim 28). Examiner considers removing functional moieties as completely defunctionalized or partially defunctionalized carbon nano tubes.

Through out their arguments, applicants bring the issue of heating the suspension at multiple places (page 9 first para, page 10 first para, page 10 last para, page 11 first para). Examiner points out that, as evident by the claim language of applicant Claim 1, heat is applied in the suspension containing a solvent. Applicant may label it as the first solvent. WO '812 teaches the suspension of derivatized carbon nanotubes in the independent claim 2. Dependent claim 28 drawn to the independent claim 2 claims removing the functional moieties. Examiner considers it as the defunctionalization of the functionalized carbon nanotubes. Dependent claim 29 drawn to dependent claim 28 claims "heating the derivatized carbon nano tubes". Reading the claim language and dependency of the claims, examiner interprets that the heat is or can be applied while the functionalized carbon nano tubes are still dispersed in the solvent. Claims 30 and 31, dependent on claim 29, specifically claim heating up to a temperature of at least 250°C and 650°C.

At the time of invention it would have been obvious to a person of ordinary skill to defunctionalize carbon nano tubes using g the art of WO '812. Rejection is based upon single prior art reference WO '812; hence, no motivation is required.

Applicants argue about defunctionalization as a function of (n,m) type. Applicants do neither claim any specific combination of (n,m) nor any specific values of (n,m). Nature '603 discloses (Figure 3a and discussion on page 605 based upon the (n,m) values) the electronic state of the carbon nanotubes. Further as WO '812 discloses, the bonding of chemical moieties are chemical in nature (Figure on page 1) and depend on the electronic state of the carbon nano tube.

### ***Summary***

The **claims 1-9, 11 and 15** are rejected.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

WO2004/070349 teaches defunctionalizing carbon nanotubes while in a host such as solvents, etc.

Margrave et al. teach defunctionalizing solvated nanotubes such that they exhibit ability to suspend in solvent similar to unreacted nanotubes.

Applicants' amendment necessitated the new ground(s) of rejection presented in this Office action. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BIJAY S. SAHA whose telephone number is (571) 270-5781. The examiner can normally be reached on Monday- Friday 8:00 a.m. EST - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Mayes can be reached on (571) 272 1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BIJAY S SAHA/  
Examiner, Art Unit 1793  
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May 17, 2009  
/Melvin Curtis Mayes/  
Supervisory Patent Examiner, Art Unit 1793